Impacts of Assimilating Remotely Sensed Snow
on the Prediction of Orographic Precipitation and
Streamflow in the Western United States
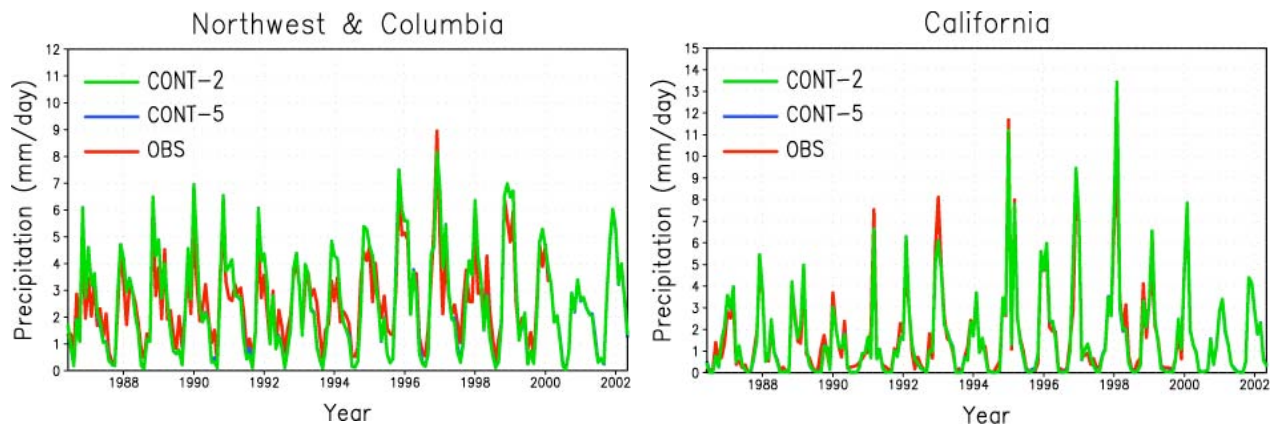
Figures

Figure 1. Observed (red) and simulated (green and blue) monthly mean precipitation averaged over the Northwest and Columbia River basin (left) and California (right). Observations are based on the University of Washington 1/8 degree data using rain gauge data adjusted for surface elevation effects.
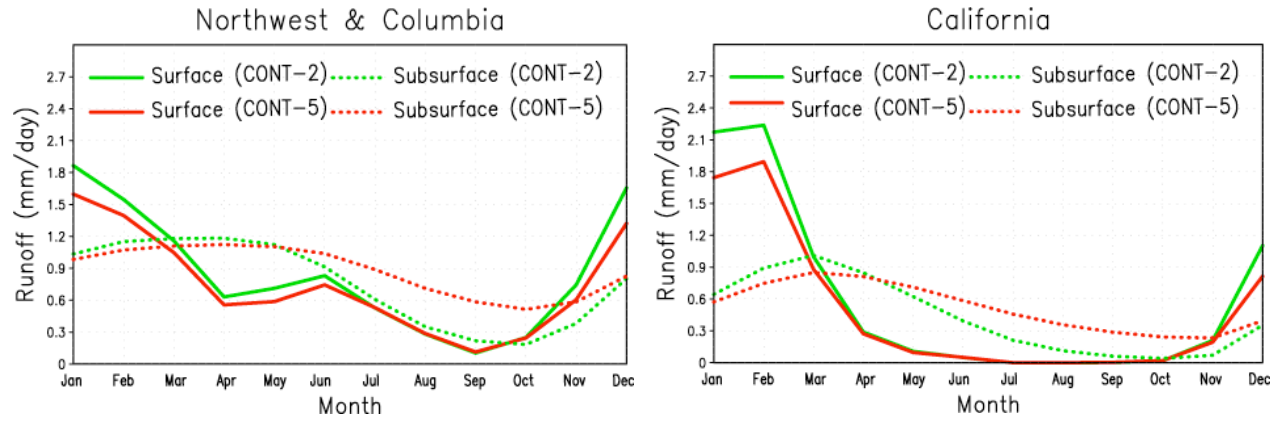
Figure 2. Long term mean simulated surface (solid) and subsurface (dotted) runoff averaged over the Northwest and Columbia River basin (left) and California (right) for the CONT-2 (green) and CONT-5 (red) simulations.
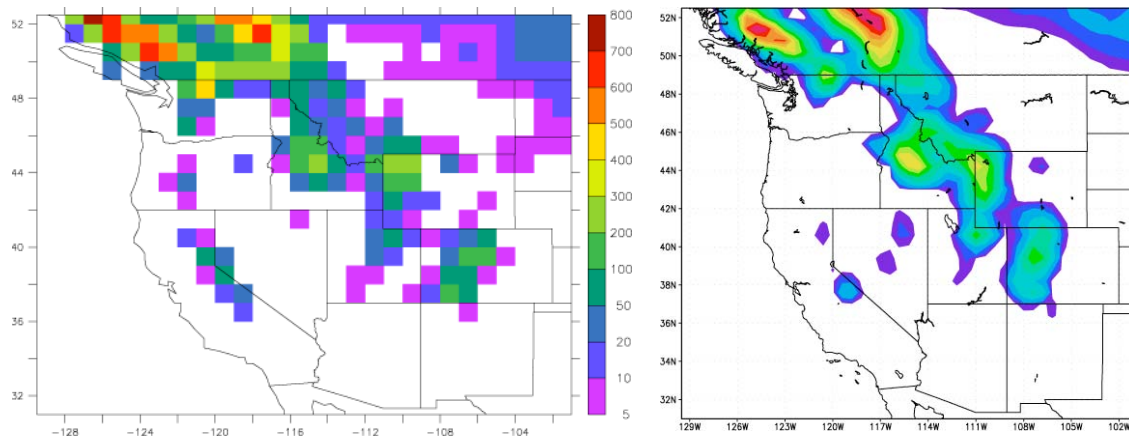
Figure 3. Long term mean observed (left) and simulated (right) snow water equivalent (SWE) for March – May in the western US. Observations are based on the Canadian Meteorological Center (CMC) SWE data gridded at 0.25 degree based on a combination of in-situ daily observed snow depth and a simple snow model. The simulated SWE on the right is based on the CONT-2 simulation. The SWE (in mm) shown in both panels used the same color contour intervals.
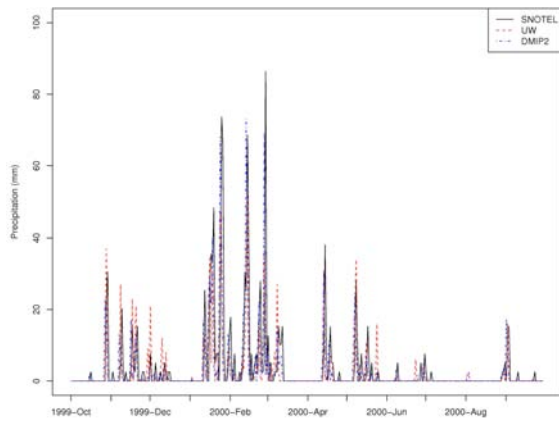
Figure 4. Comparison of daily precipitation (mm) at the Ebbetts Pass site among SNOTE (solid line), UW (red dashed), and DMIP2 (blue dot-dashed).
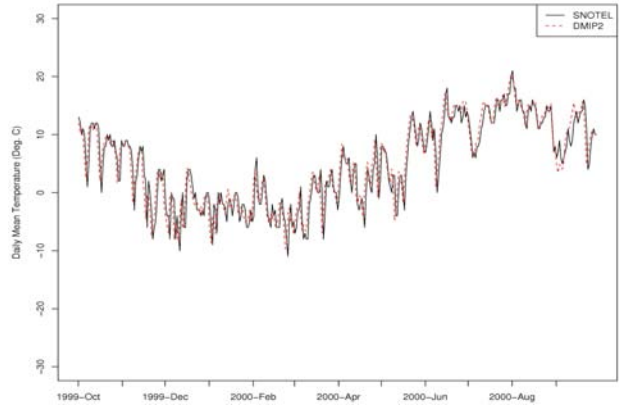

Figure 5. Comparison of daily air temperature (^{o}C) at the Ebbetts Pass site between SNOTE (solid line), and DMIP2 (red dotted line).
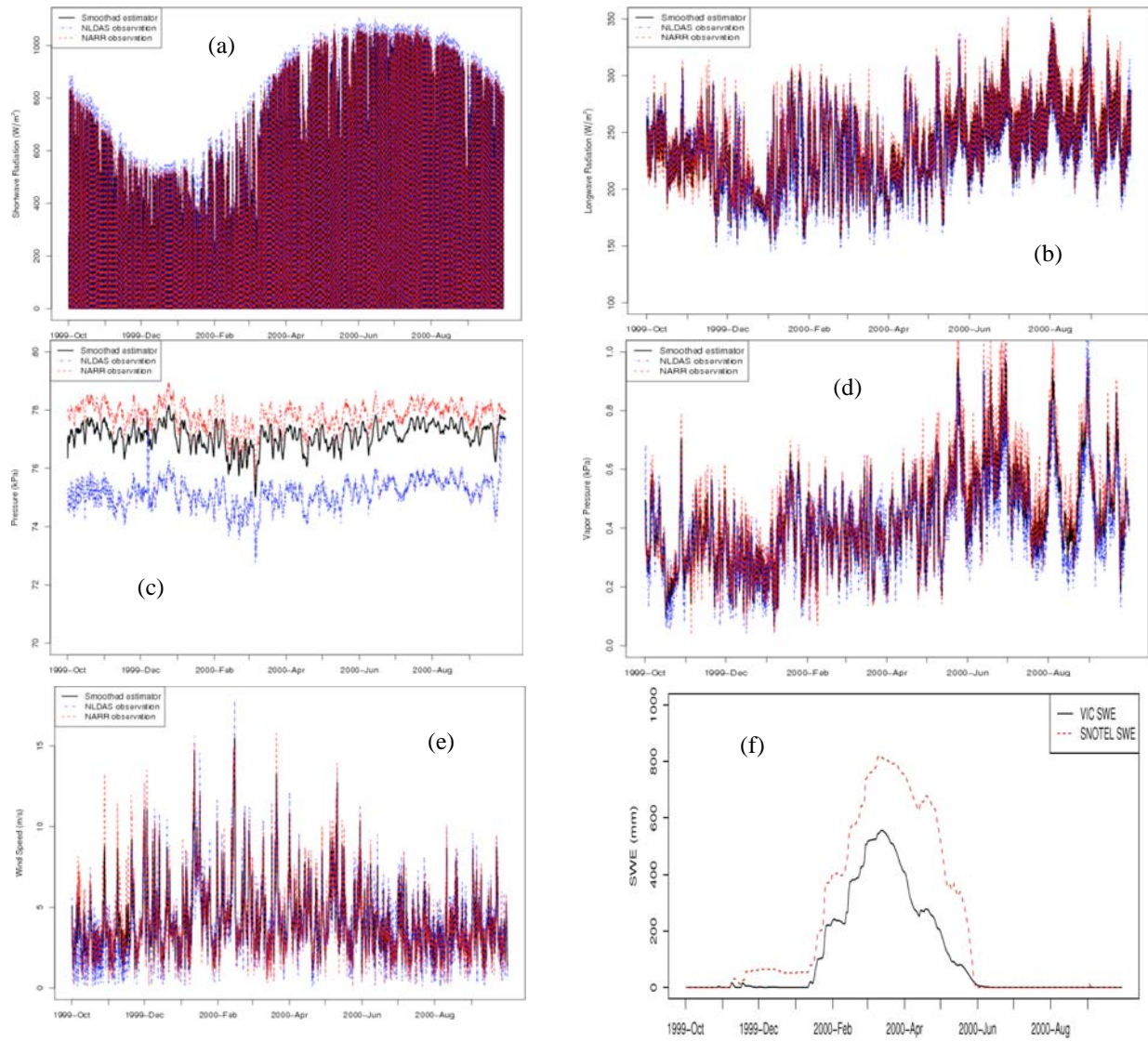
Figure 6. Comparison between NLDAS (blue), NARR (red), and the best estimates (black) at the Ebbetts Pass site for the water year of 2000: (a) solar radiation, (b) downward longwave radiation, (c) pressure, (d) vapor pressure, and (e) wind. Figure 3f shows comparison of SWE between VIC-3L and SNOTEL at the Ebbetts Pass site for water year 2000, in which the best estimates of forcings (i.e., the black curves) indicated in (a)-(e) are employed together with the precipitation and air temperature from DMIP2.
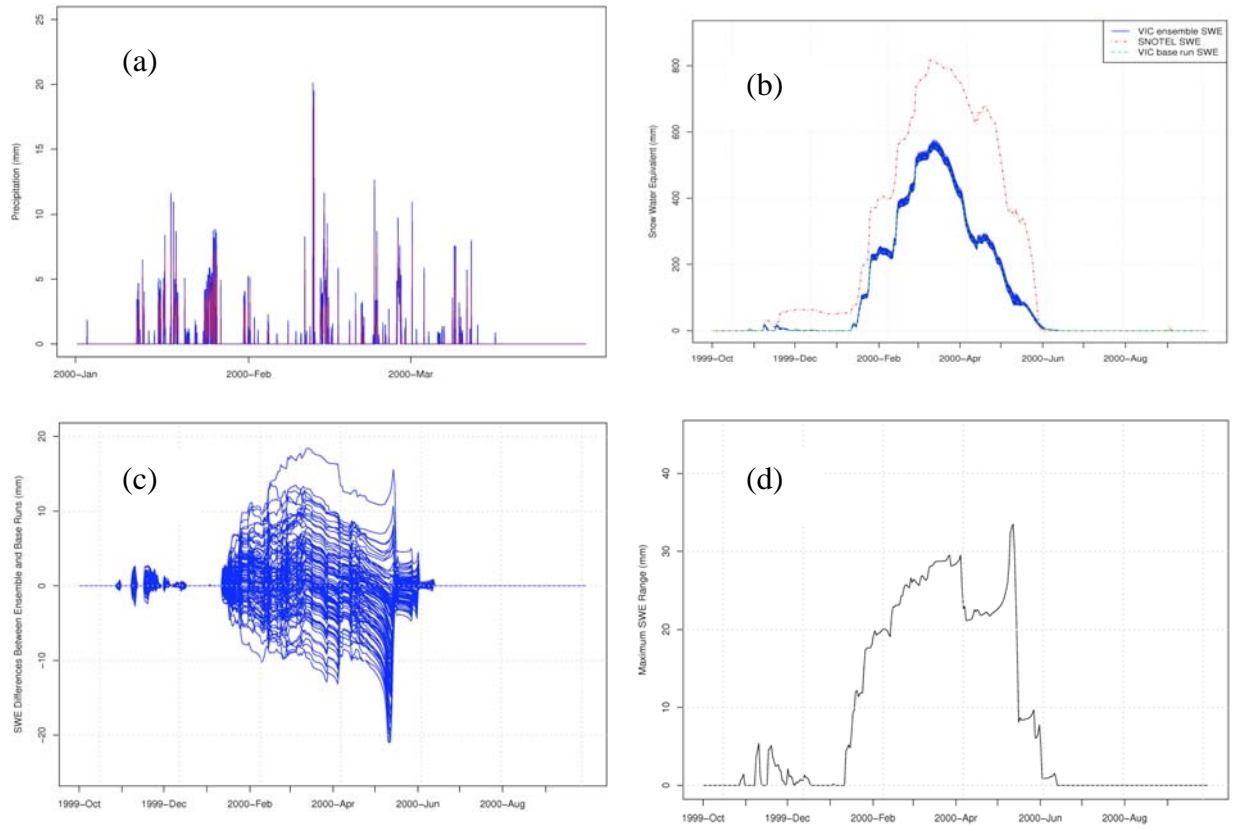
Figure 7. (a) 100 hourly precipitation ensemble members (blue) and the DMIP2 precipitation (red). (b) Comparison of SWE between SNOTEL (red), VIC-3L base run (green), and the 100 ensemble members (blue) at the Ebbetts Pass site. (c) Difference in SWE between the base run and each of the ensemble members. (d) Range of maximum difference in SWE based on the 100 ensemble SWE simulations.
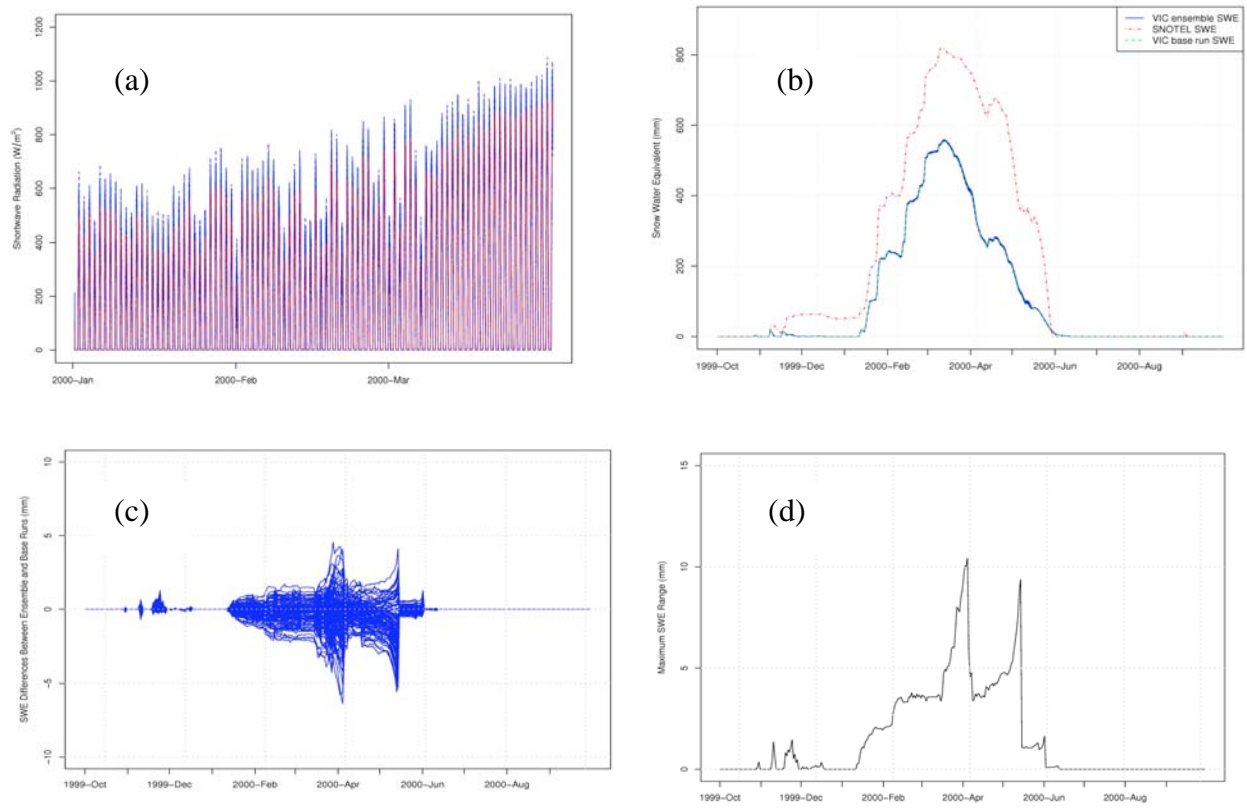
Figure 8. The same as Figure 4 except for solar radiation. Also, the 100 ensemble members of solar radiation are generated based on the data assimilation method employed to obtain the best estimates of the forcing variables.
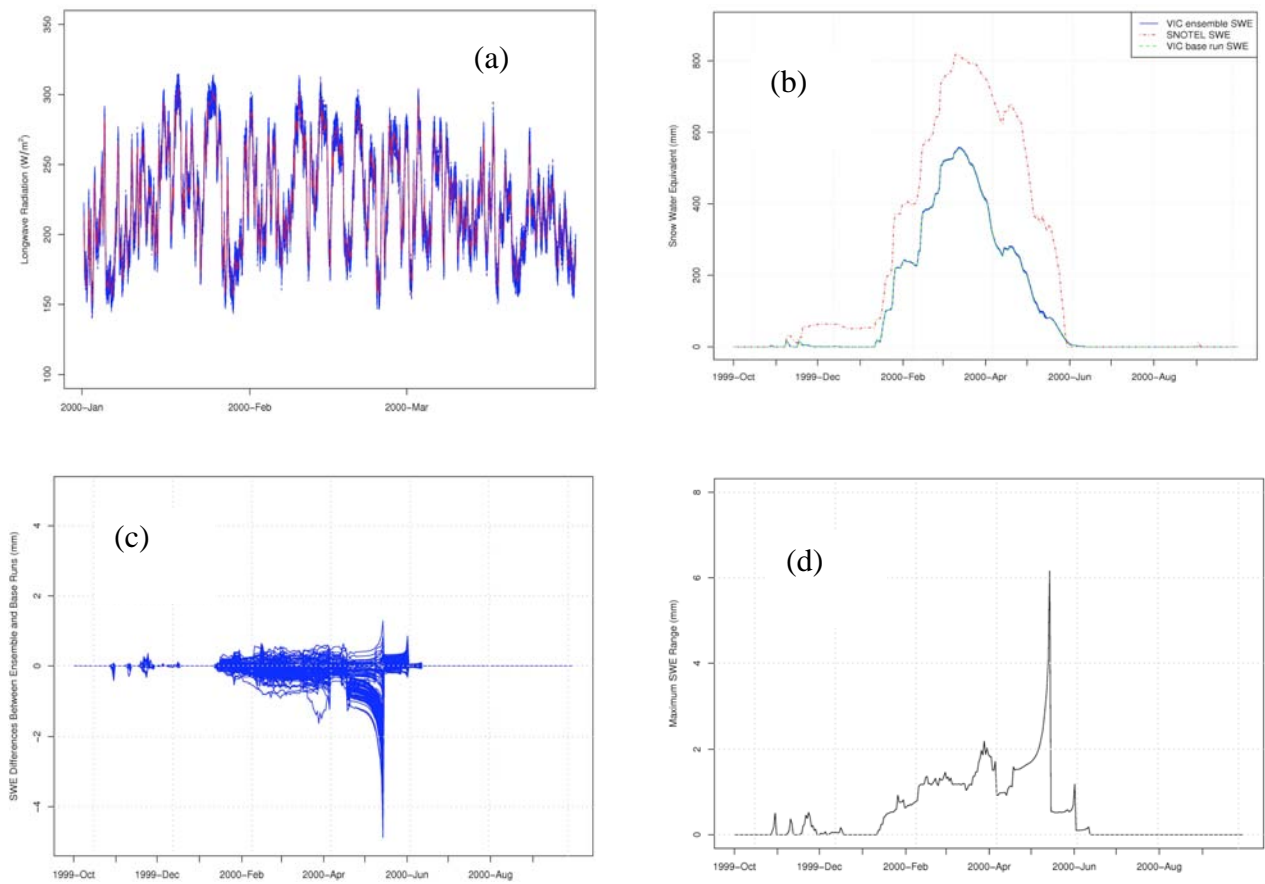
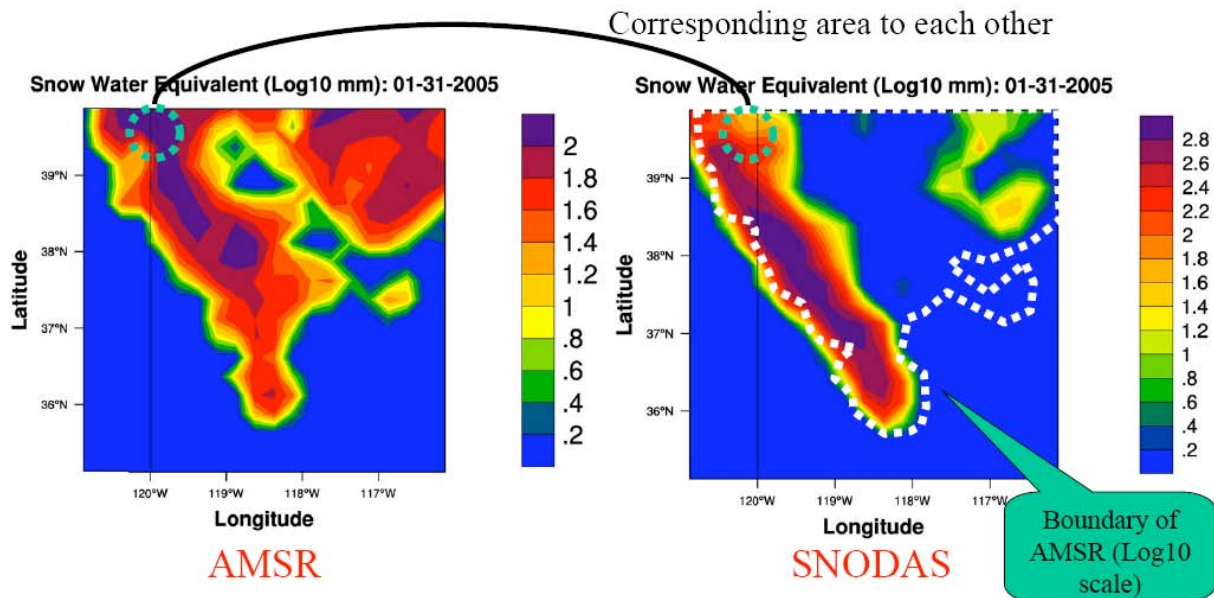Figure 9. The same as Figure 4 except for downward longwave radiation.

Figure 10. Comparison of SWE at ¼ degree resolution between AMSR and SNODAS data products for January 31, 2005. The color captions are in log base 10 scale.
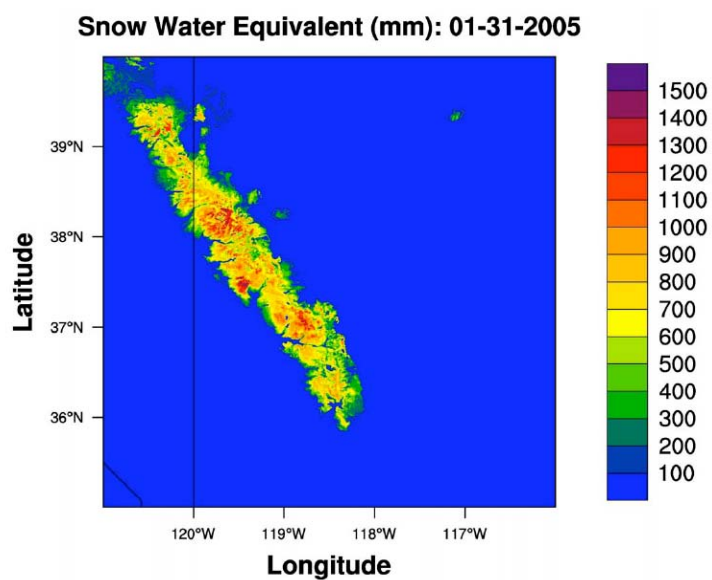

Figure 11. A spatial distribution of SWE in mm from SNODAS with 1 km resolution over the same area as in Figure 7 for January 31, 2005.